Q. With reference to Hydro's response to IIC-NLH-027:

Please provide a detailed assessment of the Dunsky conclusion that "little to no oil to electric conversions of heating in both residential and commercial sectors" will occur "due to poor economics for the customer",

(a) including all assumptions in terms of oil prices by year, efficiency of installed oil furnaces, potential displaced btu (by customer type), capital cost of mini split heat pumps, average efficiency of mini-split heat pumps, amount of individual heating load (btu) that could be shifted by customer and by customer type, and customer rates; and

(b) indicating the assumptions regarding the impact of varying levels of potential incentives;

(c) including both kW.h and kW impacts of the assumed mini-split load and the related marginal costs;

(d) ensuring all data is provided in tables, by year and by customer type, demonstrating the "poor economics; and

(e) discussing the potential for load controllers that would drop heat pump loads at peak times (e.g., when outside temperatures drop below a certain cutoff).

A. IIC-NLH-027 sought to compare conclusions between two consultant reports that studied potential for electrification, conservation and demand management in the province. Synapse Energy Economics Inc. ("Synapse") was retained by the Board of Commissioners of Public Utilities. Dunsky Energy Consulting ("Dunsky") was retained by Newfoundland and Labrador Hydro ("Hydro") and Newfoundland Power Inc. ("Newfoundland Power") (collectively, the "Utilities") to produce the Newfoundland and Labrador 2020–2034 Conservation Potential Study ("Study"). The Study was used to inform the design of the Electrification, Conservation and Demand Management Plan 2021-2025 ("2021 Plan") developed in partnership by the Utilities.

The Synapse Phase 1 report[1] referenced in IIC-NLH-027 is an older version that is superseded by Synapse's Phase 2 Report on Muskrat Falls Project Rate Mitigation ("Synapse Report").[2] As noted by Synapse "Phase 2 efforts have included more rigorous analysis of technical issues," and as such, that version will be used for discussion in the response.[3]

Differences between the results of these reports were reviewed and acknowledged as part of the Synapse Report which states that the findings of both reports roughly align. The Synapse Report specifically states "Dunsky's findings on building heat electrification appear to initially diverge from Synapse's assessment, but as noted on closer review, Dunsky does support partial provision of heat with ductless mini-split heat pumps in oil-heated dwellings."[4]

The Synapse Report acknowledges that the "Dunsky Report presents a much more in-depth analysis of local conditions and should be used for detailed input into 2020-2025 CDM program design, as was its intention."[5]

The Study's statements that "there is little to no expected fuel switching in both residential and commercial sectors", and "the customer's economics do not favour fuel switching from oil or wood fired space heating" are made in the Study with respect to analysis in the "Low Scenario – No Utility Incentives", Hydro could not find a similar scenario to compare to in the Synapse Report, where forecasts are made specific to fuel switching rates in absence of any utility incentives. It should be noted that Synapse used different scenario assumptions in constructing their models, an example being the assumptions used in Synapse's low scenario are most comparable with those used in Dunsky's high scenario. To incentivize adoption of air source heat pumps ("ASHP") in oil-heated buildings, Synapse's low scenario proposes the highest utility incentives ($1,000 per Ton installed ASHP capacity), while Dunsky's high scenario proposes the highest utility incentives (70% of cost, which approximates to $2,400 per Ton installed ductless mini-split heat pump ("DMSHP") capacity). Dunsky's high scenario and Synapse's low scenario

[1] "Phase 1 Findings on Muskrat Falls Project Rate Mitigation," Synapse Energy Economics Inc., December 31, 2018.
[2] "Phase 2 Report on Muskrat Falls Project Rate Mitigation," Synapse Energy Economics Inc., rev. 1, September 25, 2019 (originally filed September 3, 2019).
[3] "Phase 2 Report on Muskrat Falls Project Rate Mitigation," Synapse Energy Economics Inc., rev. 1, September 25, 2019 (originally filed September 3, 2019), p. 1.
[4] "Phase 2 Report on Muskrat Falls Project Rate Mitigation," Synapse Energy Economics Inc., rev. 1, September 25, 2019 (originally filed September 3, 2019), p. 127.
[5] "Phase 2 Report on Muskrat Falls Project Rate Mitigation," Synapse Energy Economics Inc., rev. 1, September 25, 2019 (originally filed September 3, 2019), p. 126.

show very similar adoption levels in the residential sector for ASHPs at the end of the study periods. The incremental energy and demand impacts to the provincial electrical system that are associated with the adoption of ASHPs naturally diverge widely given the difference in other assumptions made in the scenarios being compared between the two reports. The Study and the Synapse Report both assume greatest adoption of ASHPs to be DMSHPs in oil-heated buildings, with the existing oil heating equipment remaining in place and operational. However, Synapse models the scenario with the DMSHPs programmed to turn off at -7C outdoor air temperature, and allow the oil-fired equipment to carry the heating load beyond that point. Dunsky models the scenario with DMSHPs serving as the primary heating source for the building, and would still be operating at outdoor temperatures when the utility system is at peak demand (based on the fact the modeled DMSHP would be capable of operating at or above a COP[6] of 1.75 during peak hours).[7] As a result, the high scenario in the Study predicts higher incremental energy load associated with ASHP adoption, when residential and commercial sectors are combined. However, a much greater demand impact is also associated with Dunsky's high scenario when compared to Synapse's low scenario, due to the fact Dunsky models ASHPs as operating at peak demand periods for the utility system. It is for this reason that Dunsky concludes that the measure currently fails cost-effectiveness screening, and concludes "Prior to any considerations to encourage fuel-switching to heat pumps, the peak demand impacts of heat pumps in Newfoundland and Labrador should be verified as this study used several non-jurisdictional specific assumptions to determine peak demand."[8] Newfoundland Power is currently completing a heat pump load research study which will permit a better understanding of the energy and demand impacts of heat pump technology during peak system conditions in the province.

(a) The Study states "Measures were characterized for viable fuel switch combinations. Measure characterizations are primarily based on modified algorithms and measure assumptions from published Technical Reference Manuals (TRMs) and supplemented with

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[6] Coefficient of Performance ("COP").
[7] "Application for Approvals Required to Execute Programming Identified in the Electrification, Conservation and Demand Management Plan 2021–2025," Newfoundland and Labrador Hydro, rev. 1, July 8, 2021 (originally filed June 16, 2021), sch. 3, sch. C, p. 267 of 325.
[8] "Application for Approvals Required to Execute Programming Identified in the Electrification, Conservation and Demand Management Plan 2021–2025," Newfoundland and Labrador Hydro, rev. 1, July 8, 2021 (originally filed June 16, 2021), sch. 3, sch. C, p. 128 of 325.

other sources (e.g. RSMeans data, market actor interviews)."[9] For further discussion, please refer to Hydro's response to TC-IC-NLH-013.

(b) Table 1 shows a high level comparison between Synapse's low scenario and Dunsky's high scenario.

Table 1: Comparison of Heat Pump Scenarios

Study	**Synapse[1]**	**Dunsky[2]**
Study Scenario	Low	High
IIS[3] Domestic Rate @ Year 2030 (¢/kWh)	18.2	19.8
Total Installed Heat Pump Capacity (Tons)	3	3
Cost per Ton (DMSHP[4])	$4,000	$3,500
Total DMSHP Cost	$12,000	$10,500
Incentive Used	$1,000/Ton	70% Cost
Total Incentive	$3,000	$7,350
Residential Adoption	6%	5%
Incremental Energy (GWh)[5]	13[6]	64[7]
Incremental Demand (MW)[8]	-[9]	73

[1] Synapse's Phase 2 Report on Muskrat Falls Project Rate Mitigation, Revision 1 - September 25, 2019.

[2] Newfoundland and Labrador 2020–2034 Conservation Potential Study.

[3] Island Interconnected System ("IIS").

[4] Ductless Mini-Split Heat Pump ("DMSHP").

[5] Residential and Commercial sectors combined, excluding Institutional buildings. Institutional buildings excluded as both Synapse and Dunsky focus on residential, small commercial, and medium commercial for adoption of air source heat pumps.

[6] Derived from description Synapse's Phase 2 report, p. 46. 117 GWh from building electrification minus 104 GWh associated with electrification of Institutional buildings, leaves 13 GWh for the combined Residential, Small Commercial, and Medium Commercial sectors.

[7] The 2021 Plan, Schedule C, p. 303 of 325, Table F-20. Used the value for 2029 under upper scenario, energy increases from fuel switching (all sectors), and added the apparent escalation of 4 GWh per year to equate to Synapse's end of study year in 2030.

[8] Residential and Commercial sectors combined, excluding Institutional buildings.

[9] In Synapse's low scenario, an incremental demand impact that was associated with air source heat pump adoption, and specific to only Residential and Commercial sectors combined, excluding Institutional buildings, could not be found. Based on fig. 17, p. 48, it could be roughly estimated to be 15 MW (4 MW Residential and 11 MW Commercial; however, some may be electric vehicle related).

[9] "Application for Approvals Required to Execute Programming Identified in the Electrification, Conservation and Demand Management Plan 2021–2025," Newfoundland and Labrador Hydro, rev. 1, July 8, 2021 (originally filed June 16, 2021), sch. 3, sch. C, p. 193 of 325.

(c) Please refer to response to part (a).

(d) Please refer to response to part (a).

(e) Please refer to Hydro's response to TC-IC-NLH-019.